THE VETERINARY RECORD

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888

No. 40. OCTOBER 3rd, 1953 VOL. 65.

THE EFFECTS OF PENICILLIN SUPPLEMENTS TO THE DIET OF TURKEY POULTS AND CHICKS

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Following reports by Stokstad & Jukes (1950) that the addition of aureomycin to the diet of chicks stimulated growth, and by Whitehall *et al.* (1950) and Groschke & Evans (1950) that other antibiotics had a similar effect, it has become an almost universal practice in the United States to supplement the starter mash of chicks and turkeys with one or other of these agents. In Great Britain, Coates *et al.* (1951, 1952) confirmed that growth stimulation occurred in chicks and discussed the possible mode of action of the antibiotic.

As, generally speaking, the weights of growing turkeys in Great Britain compared unfavourably with those of birds of the same age reared under American conditions, and in view of the importance of rapid growth in turkeys destined for table use, it was decided to try the effect of the addition of penicillin to mashes available commercially in this country.

The results of preliminary experiments carried out in 1951 have been briefly reported (Wilson, 1952, 1952a). A striking increase in weight was obtained in all treated groups and there was a marked difference in mortality rates in treated and control pens. Growth rate and mortality are factors of primary economic importance to the turkey industry and very largely determine the profitability or otherwise of an undertaking ; the work was therefore extended in 1952 and following the suggestion advanced by workers at the National Institute for Research in Dairying and Glaxo laboratories (Coates *et al.*, 1951a, 1952) that the growth stimulating effect was due to suppression of micro-organisms detrimental to the host, this aspect was also investigated. Although some time has elapsed since the work was carried out the findings are considered to be sufficiently interesting to warrant publication in view of the recent interest the subject has aroused.

MATERIALS AND METHODS

Day-old turkey poults were obtained from an accredited station and reared in double-tiered, electrically heated, wire-floored brooders for the first four weeks. They were then transferred to floor brooders until eight weeks old after which they were placed in pens where they remained until killed for table purposes, usually at 26 weeks. Except in the isolation experiments which will be discussed later, the first four weeks were spent in the brooder houses at the laboratory under conditions similar to those of any well-run poultry plant except that although they were brooded in a brooder house containing several hundreds of chicks they were not exposed to the added risks of infection that large-scale commercial rearing entails. At the end of four weeks they were transferred to a large turkey farm and treated in every way as normal commercial birds. Since they were kept wholly intensively in pens of uniform size the conditions may be considered to have been controlled throughout life, particularly as there were none of the hazards associated with a possible difference in parasitic population which occurs with outside rearing in grass pens.

All poults were wing banded and individually weighed at weekly intervals. In some experiments weighing continued from day old for the full period of 26 weeks, but generally birds ceased to be available after 23 weeks as they were then required for another experiment involving the use of thiouracil during the final weeks of fattening. In others, records were kept for the first four weeks only as since most groups contained about 50 turkeys the labour involved in weighing and recording became excessive. Poults were not sexed but the sex of all casualties was noted and when it was possible to distinguish the sexes later in life a complete record was available for analysis.

As the effect of the supplement on growth rate is greatest during the first few weeks of life and as non-specific mortality of poults is practically confined to the first two weeks of rearing, great care was taken to ensure that the environmental conditions to which the poults were exposed during that period were as nearly identical as possible.

This is of much greater importance in poults than in chicks as the former are particularly susceptible to the slightest variations in light and temperature. To obtain the optimum growth from the start, poults, on leaving the incubator, were brooded at 100° F., gradually dropping during the first week to 95° F. It is essential to have both treated and controls at the same temperature for we have shown experimentally that when poults are started at 90° F.—a common temperature for starting chicks—at the end of a week there may be a difference in bodyweight of as much as 15 per cent. in favour of those groups at the higher temperature, a difference quite sufficient to vitiate the results of an otherwise critical experiment. The method sometimes employed to ensure that treated and control groups are subjected to the same temperature, by dividing the brooder into two compartments by a partition down the middle (King & White, 1953), is not altogether satisfactory because of possible differences in the density of light at the food hoppers which are usually situated at either side of the brooder. In an ordinary brooder house this may be as much as 20 to 25 foot-candles. The birds with the better-lit troughs will be more active and will be attracted to the troughs, thus consuming more food and growing faster.

There is similarly a great difference in the light of the two tiers of the brooder ; in the average brooder house the lower is generally the lighter. There may be a difference of from 10 to 25 foot-candles in the light at the upper and lower feeding troughs and from 20 to 30 foot-candles in the light at the respective water troughs.

In controlled experiments, therefore, it is necessary to arrange for as much equality of lighting as possible or to compare groups in the top tier with top tier, and bottom tier with bottom tier.

Poults were fed on commercial mash, dry *ad lib.* until they were 12 weeks old, after which they received dry mash and grain, both *ad lib.* During the first four weeks a starter mash was used, thereafter all birds received " growers' mash."

Penicillin was added to the mash at the rate of 12 grammes to the ton. In the light of present knowledge the amount of supplement fed may appear to be rather generous but when the experiments first began less was known of the optimum

level and the amount used was decided after consultation with an experienced American worker (Scott, 1951). For the sake of comparison it has continued to be used at this level. A stock premix was made by mixing 12 grammes of procaine penicillin in 14 lb. of chalk and used at the rate of 1 oz. of this supplement to 10 lb. of mash of which sufficient was prepared to provide a supply for one to two days. Feeding of the medicated mash generally continued for 12 weeks but several groups were fed from day old to 26 weeks ; the periods are shown in the tables.

TABLE I

THE EFFECT OF PENICILLIN ON TURKEYS AND CHICKS REARED INTENSIVELY UNDER NORMAL CONDITIONS DURING 1951

		Weight at four weeks			
		Control	Penicillin	Increase	% Increase
1.*	100 day-old poults	360 (16)	464 (4)	104	28·8
2.*†	107 " "	165 (34)	268 (5)	103	62·4
3(a).	100 " "	472 (3)	567 (2)	95	20·1
3(b).	100 " "	398 (6)	574 (1)	176	44·2
4(a).	108 " "	293 (13)	567 (1)	274	93·5
4(b).	107 " "	280 (10)	384 (2)	104	37·1
5.	80 " chicks	250 (2)	298 (2)	48	19·2
6.	100 " "	295	304	9	3·0
7.	60 " "	222	260 (1)	38	17·1

Figures in brackets refer to deaths.

* Chicks in Experiments 1 and 2 taken from incubator and brooded at 90° F.

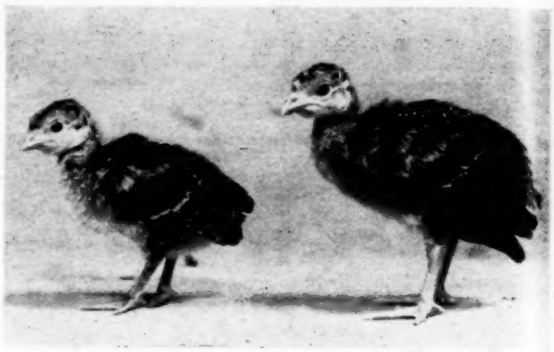
† Experiment discontinued at three weeks on account of high mortality in control pen.

In every experiment the weights of the poults receiving the penicillin supplement were very much greater than those of the controls. This, however, cannot be considered as indicative of a true growth stimulation as the weights of the treated birds except in Group 4(b) are those of normal healthy turkeys. The difference can be explained by the fact that the weights of control birds are subnormal and that the growth depressing factor present in the control pens has been overcome by the penicillin supplement.

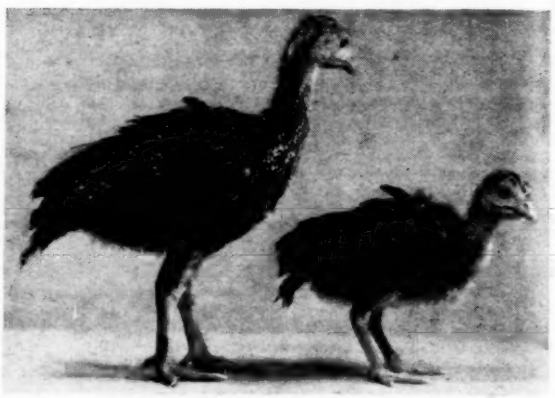
Hardly less striking was the difference in the general appearance and behaviour in the treated and untreated pens. The birds in the former were more even in size with a complete absence of the stunted bird so conspicuous in the control pens. They were more active and had much greater vitality, consuming more food and spending less time in the heated compartment of the brooder.

The greatest difference in weight of treated and control birds occurred in Experiment 4(a) and some idea of the discrepancy in size can be gained from the photographs which show a bird of average weight from each pen at two and four weeks of age respectively. Weight records were kept until the turkeys reached maturity and it is interesting to note that both birds shown remained almost exactly the average weight of their respective pens throughout the experiment.

The variable response to the antibiotic is well illustrated. Experiments 3 and 4 were duplicated under conditions as identical as could be arranged, the groups being kept in adjacent brooders in the same room. In 3(a), 3(b) and 4(a) the response of the treated birds is almost identical ; in 4(b) it is very much less. The weights of both control pens in Experiment 4 were the lowest recorded. It would appear that whatever was responsible for growth depression and which was apparently susceptible to the antibiotic in 4(a) was only partially overcome in 4(b). Since, however, the weights of both groups in 4(b) were lower it is possible that some intercurrent condition was partly responsible, although nothing could be detected.



PHOTOGRAPH 1.—Two poults two weeks of age from Experiment 4(a). Note disparity in size, the poult on the right is from the penicillin group, the left the control.



PHOTOGRAPH 2.—This shows the same poults at four weeks of age.

There was a great difference in mortality between the treated and untreated pens. In the former it was invariably low, being greatest in Experiments 1 and 2 where it was also highest in the corresponding control pens. It is possible that some chilling took place in those pens as the poults were taken from the incubator and brooded at a temperature of 90° F. In Experiment 2 the death rate was so high that the trial was discontinued at the end of three weeks. None of the deaths could be attributed to any specific infection. The usual *post-mortem* findings in poults dying during the first two weeks, in which period nearly all deaths occurred, were congestion of the lungs and distension of the gall bladder, with the crop and gizzard more or less empty.

There were odd deaths in all pens associated with accidental causes. (It is a common experience that turkeys are more prone to self destruction than chicks.) Since the poults were invariably grouped by random selection and kept under as nearly identical conditions as the controls, it would appear that the constant elimination of the growth depressing factor and the regular prevention of mortality must be attributed to the penicillin supplement.

In chicks the variable response to the antibiotic was also seen. In two out of three experiments there was a normal response ; in the third there was no difference in the weights of treated and untreated birds.

Discussion

The results described are in general agreement with those of workers in the United States, where increased growth rate in turkey poults following the use of penicillin supplements has been reported by McGinnis *et al.* (1951), Stern *et al.* (1952) and Atkinson & Couch (1952). Kramke & Fritz (1951) reported the response of chicks and poults to low levels of antibiotics including penicillin and pointed out that the maximum gains were observed at four weeks of age. With chicks, maximum stimulation rarely exceeded 20 per cent. but greater increases were observed with turkey poults. The greater effect on growth and livability in poults was confirmed by Halbrook & Beeckler (1951).

Slinger *et al.* (1951), who recorded improved growth, described considerable mortality from an unknown cause in the control pens which appeared to be prevented by penicillin. They also noted a high incidence of white feathers and suggested that the addition of antibiotics increased the dietary level of lysine required for normal feather pigmentation.

The prevention of so-called non-specific mortality such as was experienced in Experiment 2 and to a lesser extent in Experiments 3(b), 4(a) and 4(b) by penicillin supplements is confirmed by Harper & Babcock (1953), who also showed that when poults were deprived of food during the first 48 hours of life out of two lots of 40 given ordinary starter rations the mortality was 25 and 30 respectively compared to 1 and 3 in two similar groups given starter plus penicillin at the rate of 4 grammes per ton. The latter group also showed increased growth rate. This suggests that the use of such supplements would be beneficial for day-old turkeys which have travelled long distances as is a common occurrence under modern conditions.

The present discussion has been confined to the use of penicillin supplements under normal conditions of rearing; its effect on growth rate and mortality under different environmental conditions will be discussed later.

In Experiment 1 a group of 50 turkeys was fed penicillin supplement from day old until 12 weeks and a similar group was kept as a control. The poults were not sexed but by the method previously described it was determined that the sex ratios were 29♂: 21♀ and 27♂: 23♀ respectively, a sufficiently even distribution for purposes of comparison. The group on penicillin showed a marked increase in growth rate in both sexes, the effect on males being greater. This has also been pointed out by Slinger *et al.* (1951). There is practically no difference in the weights of the sexes at four weeks but with increasing ages the weight divergence associated with sexual differentiation becomes more marked. It is interesting to note that this was greater and took place earlier in the poults receiving penicillin, probably because they did not suffer from the non-specific condition causing mortality in all the control pens, and which was probably responsible for the check in growth rate in the weeks immediately following and which was apparently completely prevented by the penicillin supplement. It has been our general experience that male poults are most susceptible to non-specific disease during early life and frequently when exposed to various infections later in life stags appear to succumb more readily.

With increasing age the disparity in weight between the treated and control groups tended to become less until at 24 weeks the difference between stags was 1 lb. 12 oz. and hens 7 oz. If the birds had been kept until 26 weeks the difference would probably have been still smaller. The growth rates are shown graphically in Fig. 1.

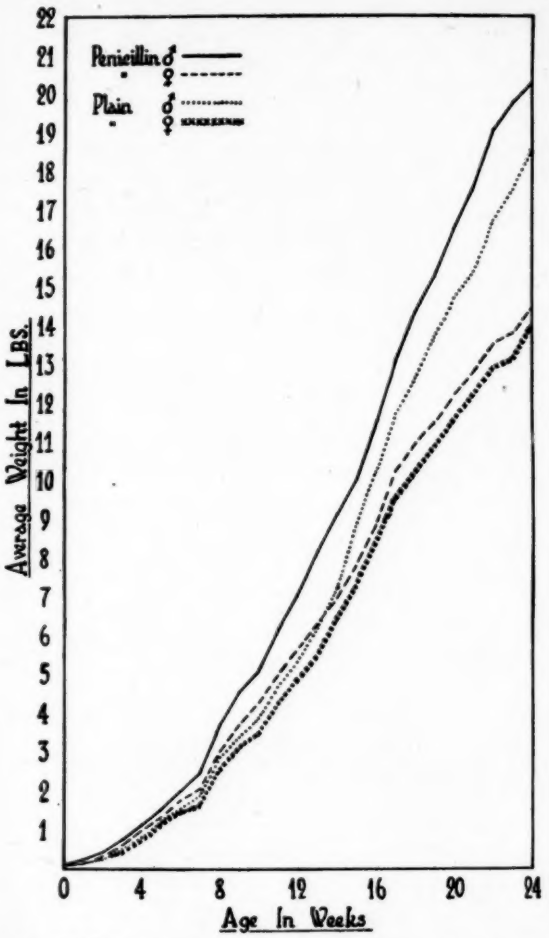


Fig. 1.—This shows the growth rate of four groups of turkeys in Table II, Experiment 1.

Experiments 2 and 3 were planned to ascertain if it was beneficial to continue feeding the supplemented mash right through to killing time or if any adverse results followed its abrupt cessation. All groups were sub-divided at 23 weeks and half of the birds receiving penicillin reverted to the ordinary diet of mash and grain, the remainder continuing on the fortified mash.

As the sexes had not been determined, the selection—a purely random one—resulted in a very uneven distribution. This was particularly marked in Experiment 3 where the ratio was 1♂ : 21♀ and 10♂ : 11♀ respectively in the penicillin groups.

The striking effect of penicillin on mortality was again shown. It will be seen from the table that twice as many birds died during the first four weeks as during the fifth to eighth weeks and there was a very significant difference in the death rate in the group receiving penicillin and those on ordinary diet. The conditions were so carefully controlled, particularly during the first four weeks, that the presence or absence of penicillin must be considered the only variable factor.

No ill effects were seen in the group previously having penicillin when the feeding of the antibiotic was discontinued. The only two deaths which occurred after the 12th week were

TABLE II. GROWTH RATES AND MORTALITY

Experiment No.	Groups of turkeys	Age in weeks: 0	4	Deaths during period	8	Deaths during period	12	Deaths during period	No. in group	13	Deaths during period	16	Deaths during period	20	Deaths during period	23	Deaths during period	Mortality: ♂	♀	Total
1.	29 ♂	60 gm. 2 oz.	500 gm. 1 lb. 2 oz.	1	1,670 gm. 3 lb. 11 oz.	1	3,206 gm. 7 lb. 1 oz.	0	27	3,688 gm. 8 lb. 2 oz.	0	5,162 gm. 11 lb. 6 oz.	0	7,488 gm. 16 lb. 8 oz.	0	8,967 gm. 19 lb. 12 oz.	0	2		
	50 Penicillin 21 ♀	60 gm. 2 oz.	436 gm. 1 lb. 0 oz.	2	1,362 gm. 3 lb. 0 oz.	4	2,550 gm. 5 lb. 10 oz.	0	15	2,864 gm. 6 lb. 5 oz.	0	4,024 gm. 8 lb. 14 oz.	0	5,532 gm. 12 lb. 3 oz.	0	6,266 gm. 13 lb. 13 oz.	0		6	8
	27 ♂	59 gm. 2 oz.	351 gm. 0 lb. 13 oz.	10	1,300 gm. 2 lb. 14 oz.	7	2,410 gm. 5 lb. 5 oz.	0	10	2,806 gm. 6 lb. 3 oz.	0	4,624 gm. 10 lb. 3 oz.	2	6,664 gm. 14 lb. 11 oz.	0	7,942 gm. 17 lb. 8 oz.	0	19		
	50 Controls 23 ♀	57 gm. 2 oz.	368 gm. 0 lb. 13 oz.	6	1,160 gm. 2 lb. 9 oz.	0	2,208 gm. 4 lb. 14 oz.	0	17	2,479 gm. 5 lb. 8 oz.	0	3,800 gm. 8 lb. 6 oz.	0	5,246 gm. 11 lb. 9 oz.	0	5,958 gm. 13 lb. 2 oz.	0		6	25
2.	28 ♂	60 gm. 2 oz.	538 gm. 1 lb. 3 oz.	0	1,782 gm. 3 lb. 15 oz.	0	3,598 gm. 7 lb. 15 oz.	0	17	4,086 gm. 9 lb. 0 oz.	0	5,748 gm. 12 lb. 10 oz.	0	7,746 gm. 17 lb. 1 oz.	0	8,794 gm. 19 lb. 6 oz.	0	0		
									11	4,338 gm. 9 lb. 9 oz.	0	6,014 gm. 13 lb. 4 oz.	0	8,054 gm. 17 lb. 12 oz.	0	9,080 gm. 20 lb. 0 oz.	0			
	54 Penicillin 26 ♀	56 gm. 2 oz.	482 gm. 1 lb. 1 oz.	1	1,502 gm. 3 lb. 5 oz.	1	2,662 gm. 5 lb. 14 oz.	2	8	3,262 gm. 7 lb. 3 oz.	0	4,506 gm. 9 lb. 15 oz.	0	5,672 gm. 12 lb. 8 oz.	1	6,210 gm. 13 lb. 11 oz.	0		5	5
									14	3,060 gm. 6 lb. 12 oz.	0	3,996 gm. 8 lb. 13 oz.	0	5,078 gm. 11 lb. 3 oz.	0	5,532 gm. 12 lb. 3 oz.	0			
	23 ♂	57 gm. 2 oz.	281 gm. 0 lb. 10 oz.	9	1,076 gm. 2 lb. 6 oz.	3	2,236 gm. 4 lb. 15 oz.	0	4	3,262 gm. 7 lb. 3 oz.	0	4,652 gm. 10 lb. 4 oz.	0	6,580 gm. 14 lb. 8 oz.	0	7,404 gm. 16 lb. 5 oz.	0	12		
									7	2,354 gm. 5 lb. 3 oz.	0	3,542 gm. 7 lb. 13 oz.	0	5,246 gm. 11 lb. 9 oz.	0	6,182 gm. 13 lb. 10 oz.	0			
	41 Controls 18 ♀	56 gm. 2 oz.	282 gm. 0 lb. 10 oz.	6	1,020 gm. 2 lb. 4 oz.	1	2,236 gm. 4 lb. 15 oz.	0	6	2,382 gm. 5 lb. 4 oz.	0	3,290 gm. 7 lb. 4 oz.	0	4,568 gm. 10 lb. 1 oz.	0	5,078 gm. 11 lb. 3 oz.	0		7	19
									5	2,920 gm. 6 lb. 7 oz.	0	3,884 gm. 8 lb. 9 oz.	0	4,624 gm. 10 lb. 3 oz.	0	5,190 gm. 11 lb. 7 oz.	0			
3.	15 ♂	57 gm. 2 oz.	482 gm. 1 lb. 1 oz.	2	1,726 gm. 3 lb. 13 oz.	0	3,458 gm. 7 lb. 10 oz.	2	1	3,744 gm. 8 lb. 4 oz.	0	5,414 gm. 11 lb. 15 oz.	0	7,628 gm. 16 lb. 13 oz.	0	8,682 gm. 19 lb. 2 oz.	0	4		
									10	3,940 gm. 8 lb. 11 oz.	0	5,476 gm. 12 lb. 1 oz.	0	7,264 gm. 16 lb. 0 oz.	0	7,998 gm. 17 lb. 10 oz.	0			
	50 Penicillin 35 ♀	58 gm. 2 oz.	454 gm. 1 lb. 0 oz.	1	1,474 gm. 3 lb. 4 oz.	0	2,780 gm. 6 lb. 2 oz.	2	21	3,144 gm. 6 lb. 15 oz.	0	4,282 gm. 9 lb. 7 oz.	0	5,302 gm. 11 lb. 11 oz.	1	5,868 gm. 12 lb. 15 oz.	0		4	8
									11	3,116 gm. 6 lb. 14 oz.	0	4,142 gm. 9 lb. 2 oz.	0	5,162 gm. 11 lb. 6 oz.	0	5,616 gm. 12 lb. 6 oz.	0			
	23 ♂	58 gm. 2 oz.	324 gm. 0 lb. 12 oz.	4	992 gm. 2 lb. 3 oz.	4	2,270 gm. 5 lb. 0 oz.	3	5	3,004 gm. 6 lb. 10 oz.	0	4,338 gm. 9 lb. 9 oz.	0	6,496 gm. 14 lb. 5 oz.	0	7,914 gm. 17 lb. 7 oz.	0	11		
									7	2,606 gm. 5 lb. 12 oz.	0	4,024 gm. 8 lb. 14 oz.	0	5,902 gm. 13 lb. 0 oz.	0	6,978 gm. 15 lb. 6 oz.	0			
	49 Controls 26 ♀	57 gm. 2 oz.	304 gm. 0 lb. 11 oz.	6	964 gm. 2 lb. 2 oz.	4	2,236 gm. 4 lb. 15 oz.	1	8	2,836 gm. 6 lb. 4 oz.	0	3,744 gm. 8 lb. 4 oz.	0	4,994 gm. 11 lb. 0 oz.	0	5,644 gm. 12 lb. 7 oz.	0		11	22
									7	2,410 gm. 5 lb. 5 oz.	0	3,514 gm. 7 lb. 12 oz.	0	4,652 gm. 10 lb. 4 oz.	0	5,050 gm. 11 lb. 2 oz.	0			
	Penicillin			7		6		6			0		0		2		0	6	15	21
	Control			41		19		4			0		2		0		0	42	24	66
	TOTAL			48		25		10			0		2		2		0	48	39	87

both in birds still receiving penicillin. Under the particular environmental conditions in which these experiments were conducted (wholly intensive rearing) where the absence of serious specific disease might be expected, it appears that as far as its effect on mortality is concerned penicillin in the diet is unnecessary after the eighth week. Where turkeys are reared extensively, its use to killing time may well be justified.

The figures provide further support for the view that the effect of penicillin is greater in male birds.

Penicillin Supplements as a Preventative of Coccidiosis

When the poults were transferred from tier brooders and placed in floor brooders on a commercial farm they became exposed to natural infection with coccidiosis.

It was found that in some groups on penicillin there were practically no deaths and the growth rate was only slightly lowered, whereas in the corresponding controls there was some mortality and growth practically ceased for a week or more. This typical behaviour is seen in Fig. 2.

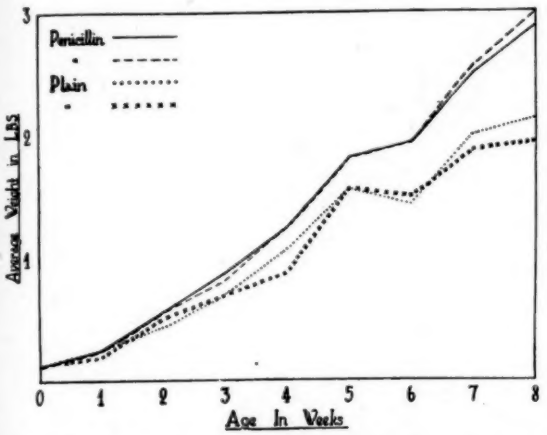


Fig. 2.—This shows loss in weight in two groups of poults fed on ordinary diet when exposed to infection at four weeks of age on a commercial farm. Groups on penicillin showed slowing-up of growth rate with no deaths from coccidiosis.

In view of these findings, and as Tod[illegible] (1951) had shown that penicillin in the food can inhibit the development of *Ascaridia galli*, it was decided to try the effect of penicillin on chicks artificially infected with *E. tenella*.

Forty day-old chicks were given the penicillin supplement until they were three weeks old when they were infected with *E. tenella* (250,000 sporulated oocysts counted by McMaster slide method). A similar number of chicks was kept as controls. There were no deaths in either group before dosing with oocysts ; the treated group was 15 per cent. heavier.

Four days after infection blood was seen in the droppings of both groups and on the following day 23 treated birds and 27 controls died. All the remaining controls died the following day and all but two of the treated birds. The carcases of the treated birds were 19 per cent. heavier than those of the controls.

The experiment was repeated using two groups of 50 chicks, one of which had received a penicillin supplement for five weeks, with similar results. It was again apparent that penicillin gave no protection against the acute disease produced by the administration of a single lethal dose of oocysts.

Todd & Wyant (1951) reported similar results and Ingram & Edgar (1951) showed that although the growth stimulating effect of penicillin on survivors of an outbreak was parallel to that occurring in unaffected controls, coccidiosis was not prevented.

In view of these results it is probable that the check in growth rate in the control groups, which was much greater than that occurring in the birds receiving penicillin, was not entirely caused by the presence of coccidia, but partly by some other " infection " acquired soon after introduction to the commercial farm and which was susceptible to the antibiotic.

Effect of Penicillin Supplement in Different Environments

The findings of the workers at the Reading and the Glaxo laboratories have been mentioned in the introduction to this paper.

Coates *et al.* (1951a) reported a marked discrepancy in the behaviour of chicks fed on a diet supplemented by penicillin at Reading and at Greenford. No growth stimulation occurred at the latter laboratory where chicks were not normally kept but did occur at Reading where chicks had been kept regularly for a number of years. It was suggested that the growth stimulating effect of antibiotics might be due to their suppression of micro-organisms detrimental to the host.

Further work by the same authors (Coates *et al.*, 1952) confirmed the presence of some " infection " detectable only by its suppression of normal growth and it was suggested that the conditions on most poultry farms would be similar to those at Reading. Our experience having been similar under what are probably comparable conditions the response of poults and chicks kept in isolation was investigated.

In Experiment 1, 120 day-old chicks were divided into four random groups of 30. Two lots were kept in the brooder house, one receiving penicillin and one mash only. The other two lots were placed in isolation in new brooders in an air-conditioned room normally used for vaccine production within a large building where chicks had never been kept.

Growth stimulation was observed in the group receiving penicillin in each environment. The experiment was therefore discontinued and more stringent precautions in the way of a completely separate food supply, utensils and attendant were

Table III
Effect of Penicillin Supplement in Different Environments

	Chicks	Exposed to infection				In isolation			
		Control	Penicillin	Difference	% Increase	Control	Penicillin	Difference	% Increase
1.*	120 chicks	140	183	43	30·7	137	171	34	24·8
2.	80 chicks	282 (1)	343	61	21·6	310 (1)	331	21	6·8
3.	80 turkeys	452	493	41	9·1	487	499	12	2·5

Figures in brackets refer to deaths.
* Experiment lasted only three weeks as it was obvious that isolation was not fully effective.

instituted for the ensuing trials. In this experiment four groups of 20 day-old chicks were kept in the brooder house, one receiving penicillin and one mash only and two similar groups were kept in isolation. After a week 20 day-old turkeys were added to each brooder. There was no evidence of growth stimulation in the groups in isolation. The response in the chicks under normal brooding conditions was marked—that of the turkeys less so. This might have been due to a low level of any "infection" to which turkeys are particularly susceptible as at the time this experiment was carried out there were no other turkeys in the brooder house. There were no deaths amongst the turkeys and only two in the chicks, one on plain food in isolation and one on plain food in the brooder house.

Failure to obtain significant growth stimulation in turkeys and chicks under the conditions of isolation described has invariably been our experience in all subsequent experiments although the weights of poults receiving penicillin have always been slightly greater than those of the controls. The apparent breakdown of the first isolation trial is of interest. It would appear that old equipment and rooms used over a lengthy period are not pre-requisites for infection for in this case the environmental conditions were almost ideal. Infection was probably conveyed by an attendant when the chicks were divided into random groups. Another possible source was the use of old chick boxes at the time of division.

These findings support the theory of subclinical infection postulated by Coates and her associates and differ from those of King & White (1953), who failed to find any evidence of an "infection."

Further support is provided by subsequent experiences on a commercial farm where after a thorough cleansing and disinfection of existing equipment and brooder rooms no significant growth stimulation occurred in any of the groups of poults brooded there, although previously as marked effects had been observed as those recorded in this paper. Similar experiences have been recorded by other workers.

Davis & Briggs (1951) showed that in old quarters the mean bodyweights of chicks over all groups receiving antibiotics was 16 per cent. heavier than those of controls but when trials were made in a newly furnished room there was no gain in weight in six groups receiving antibiotics compared with two groups on mash only.

The actual mode of action of dietary penicillin has not yet been clarified but it would appear that its effect on bacterial activity is a likely one. Some work has been done on differences in the bacterial flora of treated and untreated groups but results are conflicting. In some groups a marked reduction in the number of streptococci has been evident and this is being investigated and attempts made to reproduce the "disease."

Sieburth *et al.* (1951) failed to find significant differences in total bacteria in the caeca in groups of poults given penicillin and terramycin and controls. *B. proteus* was absent from the controls but present in the other groups. The significance of this was doubtful. In a later experiment *Cl. perfringens* was found in the caecal contents of the birds in the control pen only and it is suggested that the action of the antibiotics could be due to their preventing entero-toxaemia caused by this organism.

Anderson *et al.* (1952) found that penicillin in the diet reduced the *p*H of the caecal contents and increased the number of bacteria in the caeca. It is suggested that the higher number of bacteria might be associated with increased growth response to the antibiotic.

The administration of antibiotics in the food has been used with success against actual outbreaks of disease. In our experience, penicillin at the rate of 12 grammes to the ton has been beneficial in the treatment of acute infection with *E. rhusiopathiae* in pheasant chicks and turkey poults, losses ceasing in about 48 hours after its use.

Peterson & Hymas (1951) report successful treatment of "mud fever" in turkeys by instilling aureomycin, penicillin or terramycin into the crops of affected birds. In a group of

Table IV
Growth Rate, Mortality, Food Consumption and Costs

Expt.	Group weight day old	Group weight four weeks	Food consumption to 4 weeks	Group weight at 12 weeks	Food consumption 5-12 weeks	Regrouping at 12 weeks	Group weight at 23 weeks	Food consumption 13-23 weeks	Total food consumption	Food consumption per lb. bodyweight	Average weight of birds in lb.	Value at 4s. 6d. per lb.	Cost of food	Surplus
												£ s. d.	£ s. d.	£ s. d.
Penicillin	lb. oz. 13 12 (107)	68 (103)	216	648 (98)	1,846	Penicillin (49)	704 (46) 18 28	1,656 mash 1,062 grain	3,749	5·3	15·3	158 8 0	58 1 6	100 6 6
						Plain (49)	726 (47) 22 25	1,628 mash 1,031 grain	3,690	5·1	15·4	163 7 0	56 11 6	106 15 6
Plain	13 7 (108)	38 (85)	128	307 (65)	1,030	Plain (31)	396 (31) 17 14	1,272 mash 643 grain	2,494	6·3	12·8	89 2 0	38 4 4	50 17 8
						Plain (34)	422 (34) 13 21	1,124 mash 661 grain	2,364	5·6	12·4	94 19 0	35 19 0	59 0 0

Basis of calculations

Starter mash = 4½d. per lb.
Growers' mash = 4d. per lb.
Grain = 2·7d. per lb.
Penicillin supplement = ·1d. per lb.
Turkey meat = 4s. 6d. per lb. live weight.

Weights of food include wastage. Figures in brackets show number of birds alive. Food consumption and group weights are in lb.

600 poults in which the disease occurred suddenly, losses ceased within 48 hours after treatment with 100 p.p.m. of terramycin in the mash.

The Economic Aspect

Experiments described earlier in the paper showed that the addition of penicillin to the mash resulted in increased growth particularly during the first four weeks of life when it also had a marked beneficial effect on non-specific mortality. There appeared to be no benefit in continuing the supplement after 12 weeks under the special conditions under which the birds were kept. It was considered desirable to investigate the economics of treatment as this is an important aspect from the commercial point of view.

The poults used in Experiment 4 (Table I) had been retained on a commercial farm, and complete records of food consumption were available from day old to the 23rd week. At the 12th week the pens had been split and half of the birds receiving penicillin reverted to plain food. Records of food consumption, weight gains, food conversion ratios and mortality are given in a condensed form in Table IV.

The final bodyweight of a turkey is not necessarily a good criterion of profitability. Many factors must be considered, *e.g.*, after a certain stage any additional bodyweight may be uneconomic in view of overhead costs. In this experiment the birds had not reached that point and the additional weight represented a gain of about 10s. to 12s. per bird. The chief value of the supplement, however, is seen in its effect on mortality.

Including all deaths from day old to 23 weeks, the total mortality was just under 13 per cent. In the control pens under identical conditions it was 39 per cent. There were no deaths in the control pen after the 12th week. Many occurred during the first two weeks and there were further deaths during the fifth to seventh weeks from coccidiosis which was the only specific disease seen. The birds receiving penicillin in adjacent pens showed no clinical evidence of the disease. The figures also show the important effect mortality exerts on the profitability or otherwise of a rearing plant.

Throughout the experiments the increased livability of the treated birds has been a striking feature and it is probable that in combating adverse conditions antibiotics in the food are of greatest value. It is likely that where turkeys are kept under ideal conditions, the feeding of any antibiotic supplement is unnecessary ; the response, if any, will be minimal. In the large commercial plant, however, with its almost inevitable problems and the necessity for considering the economic aspect of every move, it is difficult if not impossible for even the most efficient and progressive management to maintain an ideal environment. There is the ever-present risk of introduction of " infection," its rapid propagation, accumulation and spread. The results obtained appear to indicate that under such conditions the use of penicillin is entirely beneficial.

Summary

Under the environmental conditions in which the experiments described were carried out, the addition of penicillin at the rate of 12 grammes to the ton invariably produced growth stimulation in turkey poults except under the specialised environment produced by extreme isolation when no growth increase was noted. This confirms the experience of workers at Reading and Greenford and in America.

The supplement is effective in reducing mortality from non-specific causes, among which may be the " infective " agent postulated by other workers. Its use is followed by a greater weight of turkey flesh at killing time. For these reasons the addition of penicillin supplement to starter mashes for young turkeys and its continuance for at least 12 weeks appear to be amply justified.

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ACTINOMYCIN IN THE TREATMENT OF MALIGNANT GROWTHS

Recently the *Daily Telegraph* reported from Rome that Professor S. A. Waksman, of Rutger's University, U.S.A., told the International Congress of Microbiology there that actinomycin has proved of value in the treatment of malignant tumours. According to the report, the use of actinomycin has been made possible by the elimination of its toxic characteristics. It is said to have been tested in 150 cases with " considerable success," particularly against malignant tumours of the lymphatic system.

" In 1940," comments *The Pharmaceutical Journal*, " S. A. Waksman and H. Boyd Woodruff contributed a paper on Bacteriostatic and Bactericidal Substances Produced by a Soil Actinomyces to the *Proceedings of the Society for Experimental Biology and Medicine* (p. 609). They reported that they had isolated a substance consisting of two compounds which they designated actinomycin A and B. The first was stated to be highly bacteriostatic but weakly bactericidal, inhibiting many gram-positive organisms in dilutions of 1 in 100,000,000 and gram-negative organisms in concentrations of 1 in 5,000 to 1 in 100,000. Actinomycin B was found to be weakly bacteriostatic but more actively bactericidal.

" The more recent work on actinomycin C, which appears to be the compound described by the *Daily Telegraph*, has been published in Germany. A report from G. Shulte (*Z. Krebsforsch*, 1952, **58**, 500) states that beneficial effects were obtained in lymphogranulomatosis, and cachexia was reduced in carcinoma patients. No toxic effects were observed in the doses used. Cases which were resistant to the antibiotic were also resistant to X-ray therapy. Professor Hackman (*Ibid.*, 1952, **58**, 607) found the LD_{50} in mice to be 1 mgm. per kilo bodyweight for intravenous injection; in repeated injections smaller doses caused serious damage to the intestinal mucosa. In a further paper (*Strahlentherapie*, 1953, **90**, 296) on actinomycin C, Professor Hackman referred to its distinct cytostatic action and stated that the substance had a very pronounced inhibitory effect particularly on the lymphatic system. He suggested that it might have therapeutic uses in malignant disease."

OBSERVATIONS ON THE SUSCEPTIBILITY TO TUBERCULOSIS OF PIGS FARROWED BY INFECTED SOWS

BY

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Comment has already been made on the ability of the pig to withstand relatively large doses of tubercle bacilli injected intraperitoneally (Luke, 1951). In that work a total of 57 pigs had been infected by the intraperitoneal injection of bovine-type culture. In addition, 52 pigs had been infected in a similar manner, using an avian-type culture. None of this avian-infected group showed any clinical evidence of a generalised infection. Of the 57 pigs infected with the bovine-type culture only two showed clinical evidence of a subsequent generalised infection. In one of these evidence of generalisation became apparent six and a half months after infection and in the other case clinical tuberculosis manifested itself five months after infection. All the pigs in these two groups were infected between four and six weeks of age and with the two exceptions noted were under observation up to bacon weight at the termination of the various experiments. In some of these carcases at slaughter no macroscopic evidence of tuberculosis was found and in the others a varying degree of infection was present. In no case, however, was there any very apparent interference with growth, and weight gains were within what might be expected under the particular conditions of management. All these pigs were farrowed at the laboratory and were the progeny of non-infected sows. All were infected in the same way by the intraperitoneal injection of 0·5 ml. of a culture suspension standardised to between No. 1 and No. 2 tubes on the Brown opacity scale.

In the course of the experimental work some litters were obtained from infected sows. These were infected in the same way, using the same culture of bovine-type organisms as was injected into the pigs referred to above. It soon became evident that the progeny of these infected sows showed a much increased susceptibility to the test inoculum. A brief history of five such litters is given below.

Litter A contained eight pigs, farrowed by an avian-infected sow. They were infected when 29 days old. Symptoms of disease became apparent 10 days later and the first death occurred 31 days after infection. The remaining seven pigs were all dead within the following 18 days.

Litter B was also the offspring of an avian-infected sow and seven pigs were infected at 44 days old. Clinical evidence of disease was apparent at the beginning of the third week after infection. The first pig died 30 days after infection and the rest of the litter had died or were killed *in extremis* within 42 days from the infection date.

Litter C was obtained from an avian-infected sow. Six pigs were infected when 36 days old. The first death took place 23 days later and the remaining five pigs were killed when showing marked symptoms within 30 days after infection.

Litter D was farrowed by a mammalian-infected sow. Only four pigs were available for infection at 32 days old. The first death occurred 28 days later and the remaining three pigs died within the following five days.

Litter E was from an avian-infected sow. Four out of nine pigs were infected with the bovine culture and within three weeks all were showing evidence of generalised infection. They were killed 28 days after infection.

Up to date 29 pigs from sensitised sows have been infected with the bovine culture and in all cases rapid generalisation of the disease took place. Symptoms were observed as early as 10 days after infection. At first there were those associated with an increasing disturbance of digestion and nutrition. Appetite became capricious and later almost completely suppressed. The pigs became less lively, the tails hung loosely and there was a very rapid loss of condition. Bouts of diarrhoea were observed, the back became arched, the flanks sunken and the abdomen pendulous. In the later stages coughing was seen and eventually the pigs were unable to stand. The course of the disease was comparatively short and death took place in some cases as early as 23 days after infection.

Post-mortem examination in all cases showed extensive generalised miliary tuberculosis involving the peritoneum, omentum, liver, spleen, lungs and all the carcase lymph glands. As will be reported elsewhere (Luke, 1953), the *post-mortem* appearance of these pigs was very similar to that shown by infected pigs (from non-sensitised dams) treated with adrenocorticotrophic hormone or with cortical extract.

The five pigs which remained in Litter E received 0·5 ml. avian-type culture intraperitoneally. This litter was weaned 14 days later and the avian-infected lot placed in a separate pen for further observation. The results in this case were not so decisive as in the bovine-infected pigs. In the weeks following infection there was no marked loss of condition. Growth was certainly slowed down, the appetite variable and an intermittent diarrhoea was present. Six weeks after infection a *post-mortem* examination was carried out. In three of these pigs there was a diffuse granulomatous peritonitis involving mainly the caecum and colon. Similar lesions were present on the surface of the liver, and lesions in the mesenteric and gastric lymph glands. Acid-fast organisms were present in smears prepared from these lesions. In these three pigs the evidence of the avian infection was much more extensive than in any of the previous experimental avian infections. In the other two pigs in this group no macroscopic evidence of disease could be found.

In view of the fact that the pigs were being suckled by infected dams, the question of possible transfer of infection from dam to offspring must be considered. Although adequate scientific control on this point is difficult to devise in practice, it is being kept in mind in experiments at present under consideration ; but, for a number of reasons, it is felt that direct transmission of infection from dam to offspring was not responsible for the results recorded above. Of the five litters discussed, four were farrowed by avian-type-infected sows. These sows were under observation for varying periods up to over three years. They had been infected at six to eight weeks of age. Skin sensitivity had been maintained over the period of observation and regular testing had shown a typical avian reaction. The sows remained healthy. The lesions in the young pigs, on the other hand, were judged to be typical of the bovine-type infection and in the case of two of the litters gave a positive biological test, using guinea-pigs. One litter each from a bovine-type-infected sow and an avian-type-infected sow were reared up to 14 weeks of age without any evidence of infection as judged by the thriving condition of the pigs and negative tuberculin tests. Furthermore, in the case of one of the litters mentioned (Litter D) three of the pigs were left as uninfected controls. These were kept in the same pen as the four infected litter mates. As already indicated, these four experimentally infected pigs all showed clinical evidence of generalised tuberculosis and all died within a period of 33 days following infection. The three control pigs remained clinically healthy and continued to put on weight up to six weeks later when they were killed for *post-mortem* examination. They were tuberculin skin tested prior to slaughter and all

showed a marked reaction to mammalian tuberculin. Lesions of tuberculosis were found in one or more of the following sites only : sub-maxillary, portal and bronchial lymph nodes. These findings indicate inhalation or ingestion as the path of infection in these cases. (The effect of routes of infection other than intraperitoneal on the course of the disease in these pigs farrowed by infected sows remains to be investigated.) In addition, intradermal tuberculin tests on four of the five litters prior to infection were uniformly negative.

On the evidence gained so far from these preliminary investigations it would be unwise to draw definite conclusions as there are many aspects of the immunological status of these pigs which require further clarification. It is of interest to note, however, that the pathological picture here is very similar to that seen in infected pigs treated with adreno-corticotrophic hormone. In these latter cases, too, there is rapid generalisation of the disease.

Summary

Evidence is presented which suggests that young pigs farrowed by infected sows are much more susceptible to experimentally induced tuberculosis than are those born of uninfected dams.

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Effect of Agene on Health

In an address on " Good Food " at the annual conference of the Association of Municipal Corporations at Blackpool, Dr. Hugh Paul, Medical Officer of Health for Smethwick, Staffordshire, said that so far there was no convincing evidence that flour treated with agene had any toxic action on man, but some of the nervous debility from which people were said to be suffering might be caused by prolonged poisoning by small amounts of agene.

There should be a scientific body charged with the duty of ascertaining the effect on health of the addition or subtraction of chemicals in food, and in ports, towns and villages there should be adequate supervision of the production and distribution of food.

SALMONELLAE IN CEYLON DOMESTIC ANIMALS

BY

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Salmonella infections in domestic animals are considered a potent source of infection to man (Kauffmann, 1941; Topley & Wilson, 1946).

From the public health point of view it should be mentioned that there are few, if any, Salmonella types strictly reserved to man or animals only (Hinshaw, 1949).

Diseased and emergency slaughtered animals are reported to cause up to 48·1 per cent. of all food poisoning in man (v. Ostertag, 1932).

Most of the investigations on Salmonella infections in animals were done by examining mesenteric glands, which in a filter-like action may confine bacteria constantly to them, and this source of infection to man would be subsequently removed with the viscera after slaughtering.

Symptomless carriers, however, constitute another potential source of spreading the infection to man and other susceptible animals. Practically, there is no species of domestic animal exempted from the possibility of becoming a symptomless carrier (Smith & Buxton, 1951).

This investigation was therefore carried out by examining faeces of healthy animals from the Colombo slaughterhouse, from the municipal dog pound, and from markets (chicken and ducks). The animals supplied to the Colombo slaughter-house originate from all over the island ; only goats imported from India are shipped to Ceylon from South Indian ports. Stray dogs are caught within the Colombo municipal area and are kept for three days in the dog pound before being destroyed. The supply of poultry to Colombo markets originates mostly from the environment of Colombo.

The samples were collected as pooled faeces from each pen, holding three animals on the average, and were examined by direct plating on SS-Agar and enrichment in tetrathionate broth with subsequent subculturing after 24 hours. The results are shown in the table.

	No. of speci-mens	*S. para-typhi B.*	*S. saint-paul*	*S. typhi murium*	*S. virchow*	*S. newport*	*S. dublin*	*S. galli-narum*	*S. poona*	*S. urbana*	Total
Buffaloes	16	—	—	—	—	—	+	—	—	—	—
Cattle	61	—	—	—	1	—	—	—	—	—	1
Dogs	33	—	—	1	—	—	—	—	—	—	1
Chickens...	62	—	—	—	—	—	—	1	—	—	1
Goats	48	1	1	—	1	—	—	—	—	—	3
Goats (imported from India)	58	—	1	—	—	1	—	—	3	2	7
Ducks	19	—	—	—	—	—	—	—	—	—	—
Pigs	60	—	—	—	—	—	1	—	—	—	1
Sheep	20	—	—	—	—	—	—	—	—	—	—
Total	377	1	2	1	2	1	1	1	3	2	14

Discussion

All the above organisms, except *S. dublin*, *S. gallinarum* and *S. urbana*, have been found in human infections in Ceylon. *S. virchow* is a very common cause of gastro-enteritis in man in Ceylon, as it accounted for 336 (5·94 per cent.) of 5,656 Salmonellae isolated during the past three years. Taking into account only Salmonellae other than *S. paratyphi A* and *S. typhi*, *S. virchow* was found to account for 33·01 per cent. of 1,018 isolations (Schmid, 1953).

Weekly Wisdom

Many of our questions turn out to be wrong because they are unanswerable, but it is only by asking them at all that we eventually find we have asked the right one. One knows how oddly, how unreasonably I might almost say, the right question has often flashed into men's minds. . . . What I do know, from my own experience, is the fruitlessness of pondering over a scientific problem too long. The mind gets polarised and thought becomes captive to a groove. How often the best way of solving a scientific difficulty is to leave it alone !—Sir Edward Appleton (Presidential Address to the British Association).

Goats imported from India gave the highest rate of isolations during this investigation and deserve particular attention for quarantine.

In the tropics, animals, including other than those in moderate climates, may live in closer association with man, and may also be liable to Salmonella infections. Elephants were found positive for *S. typhi murium* (McGaughey *et al.*, 1953), *S. wichita* was isolated from a bandicoot (*Bandicota malabarica*), and *S. typhi* was isolated among other Salmonellae from rats (Schmid *et al.*, 1953).

Summary

Nine Salmonella types, *i.e.*, *S. paratyphi B*, *S. saint-paul*, *S. typhi murium*, *S. virchow*, *S. newport*, *S. dublin*, *S. gallinarum*, *S. poona* and *S. urbana*, were isolated from domestic animals in Ceylon. Positive results were obtained in one of 61 cattle, one of 33 dogs, one of 62 chickens, three of 48 goats, seven of 58 goats imported from India, and one of 60 pigs.

Acknowledgments.—We wish to thank Dr. D. W. Amarasinghe, Chief Municipal Veterinary Surgeon, and Mr. S. Savaranamuttu, Superintendent Colombo Slaughterhouse, for their co-operation.

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"CLEAN FOOD LAWS"

In its issue of September 18th and under the above heading, *Truth* observes: "Last week's call for a clean meat campaign by Mr. A. M. Graham as President of the British Veterinary Association and Superintendent Officer of the Ministry of Agriculture, deserves to be strongly supported. British laws relating to the purity and cleanliness of food sold for human consumption are absurdly behind those of America. Mr. Graham pointed out that unsuitable meat is sold to the public and that the supervision of butchers' shops is quite inadequate, as it indeed is, for the protection of the public.

"But it is not only in butchers' shops that the law requires tightening up. In fruiterers', fishmongers' and grocers' shops laxity also prevails. Flies crawl over exposed food unprotected from them; cats are seen left to walk unrestrained, and uninstructed people even smile to see them asleep in food-shop windows over a week-end; food-shop assistants handle food with dirty, unwashed hands, and even while smoking. Most—but not all—food-shops allow dogs to be brought in, unleashed and under no control.

"Pending fresh legislation a few local authorities, like the Holborn Borough Council, for example, have started a Clean Food Campaign on voluntary lines in conjunction with local Chambers of Commerce and traders' associations. This is excellent and should be extended amongst local authorities.

"Local Councils, however, should not lose sight of the fact that the law, even as it stands, gives them certain compulsory powers. Their sanitary inspectors should not regard their duties as merely condemning blown tinned food. They should use their existing powers under the Public Health Acts for action in all cases of food unfit for human consumption."

CLINICAL COMMUNICATION

CEREBRAL PIROPLASMOSIS IN CATTLE

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Cerebral piroplasmosis in cattle caused by *Babesiella berbera* was described by Tchernomoretz (1943), while cerebral babesiasis in the dog was reported by Purchase (1947). Hitherto, however, no reference has been made to *Babesia bigemina* causing a cerebral disease.

During the past year several cases of a condition in cattle were investigated in the Southern Province of Nyasaland, in which the clinical symptoms and gross pathological changes resembled heartwater disease. Microscopical examinations of brain smears did not, however, reveal the presence of *Rickettsia ruminantium*, but instead the brain capillaries were found to be packed with red blood corpuscles containing forms of *Babesia*.

Animals of all ages, including young calves, appeared to be susceptible to the disease. So far, 15 cases have been diagnosed, all of which occurred in European-owned, mostly grade, Friesian cattle. These 15 animals belonged to eight estates, situated on two converging roads, leading from Blantyre via Limbe to Mlanje. Some of the affected estates were in close proximity, while others were quite far apart.

All cattle on the above estates are regularly (every seven days) dipped in an arsenical dip. The tick infestation on these estates is quite low, and while most of the animals which died from the disease seemed to be free of ticks, on one young calf alone, a very great number of blue ticks—*Boophilus decoloratus*—were found.

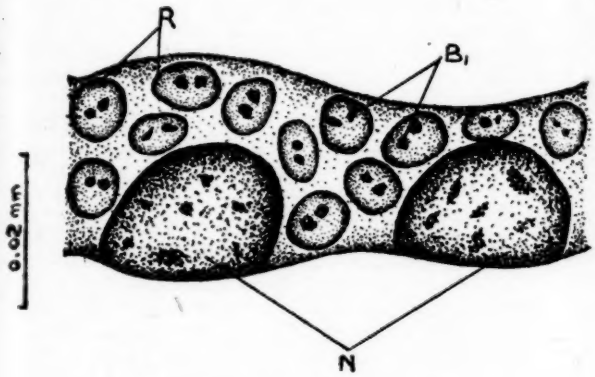
It is worth noting that in the area mentioned between Blantyre and Mlanje, heartwater, redwater and occasionally anaplasmosis are prevalent. The district is free from trypanosomiasis, and East Coast fever is absent from the Southern Province.

Clinical Symptoms.—The onset of the disease is very sudden and the course usually very rapid. Animals often appear to be normal in the morning, but in a few hours develop a very high temperature, 106° to 107° F. ; respiration is laboured, there is grinding of the teeth and loss of appetite is complete. Very soon the gait becomes staggering and the cow either lies down, keeping the head twisted to one side, or stands with its forehead pressed against a wall. Visible mucous membranes are often injected and occasionally jaundiced. There is no discoloration of the urine, but in one case red-coloured urine was passed some minutes before death. Death takes place in 12 to 36 hours. In two cases only did recovery take place, and that after several relapses.

Post-mortem Appearances.—The most striking changes are as follows : The brain shows acute hyperaemia and the cranial cavity contains varying amounts of straw-coloured or reddish fluid. An accumulation of fluid is usually observed in the pericardium and haemorrhages invariably are present under the endocardium. The liver is slightly enlarged and pale, the gall bladder being distended to about two to three times its normal size. The spleen is only slightly swollen and somewhat soft. In a few cases inflammation of the fourth stomach was observed.

Microscopical Examination.—In all but two cases examination of blood smears was negative. In two animals which survived a few red blood corpuscles were found to contain typical forms of *Babesia bigemina*. Spleen smears in all but three animals were completely negative. Brain smears invariably revealed enlarged capillaries with swollen endo-

thelial cells, the lumina of the capillaries being filled with red blood cells, each containing a pair of contracted forms of *Babesia* (Fig. 1). In only one calf, destroyed a few hours after the onset of the disease, and brain smears examined immediately after death, were the red corpuscles within the cerebral capillaries parasitised by typical forms of *Babesia bigemina* (Fig. 2).



Description of Figures

Fig. 1.—Contracted forms of *Babesia* in the red blood corpuscles within the brain capillaries.

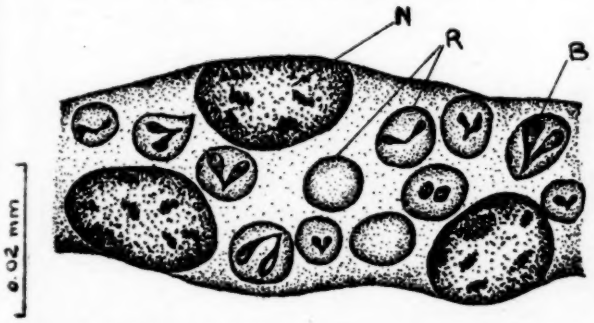


Fig. 2.—Typical form of *Babesia bigemina*, as seen in the cerebral capillaries of a calf immediately after death.

The above two figures represent *camera lucida* drawings.

B = *Babesia bigemina*.
B_1 = Contracted forms of *Babesia*.
N = Nuclei of swollen endothelial cells.
R = Red blood corpuscles.

Diagnosis.—Clinical diagnosis of the condition is very difficult, and in the absence of parasites in blood smears and the similarity of symptoms to heartwater the latter disease is suspected. Diagnosis is sometimes possible in the rare cases where parasites can be demonstrated in blood smears. Usually, however, the disease is identified only after death when brain capillaries are found to be packed with parasitised red blood corpuscles.

Treatment.—Drugs used for treatment included uleron, pirevan, sulphamethazine and mepacrine, but without apparent success.

Discussion

In ordinary *Babesia bigemina* infection there is a progressive destruction of the red blood corpuscles leading to severe anaemia, and parasites are usually very numerous in the peripheral blood and in the spleen. In the cerebral form, however, the blood picture shows very little alteration and organisms are either absent, or very rarely seen in blood smears. It appears that all the parasites accumulate and most probably multiply in the cerebral capillaries only.

Babesiella berbera, according to Tchernomoretz (1943), is less numerous in the general circulation than *Babesia bigemina*. Fatal infections in calves, however, were produced by the former in which blood smears showed few or no parasites. Blocking of the brain capillaries by parasitised red corpuscles was found to be an important contributory cause of death. On the other hand, it is known that *Babesiella berbera* seldom if ever causes widespread destruction of red cells, and consequently anaemia. It seems obvious from the foregoing that the behaviour of *Babesia bigemina* in the cerebral form is very similar to that of *Babesiella berbera*.

Acknowledgment.—I wish to thank the Director of Veterinary Services, Nyasaland, for reading the manuscript and for permission to publish this communication.

References

Purchase, H. S. (1947). *Vet. Rec.* **59**. 269.
Tchernomoretz, I. (1943). *Ann. Trop. Med. Parasit.* **37**. 77.

ABSTRACTS

Aureomycin in the Treatment of Heartwater*

The results of this work have been obtained from the treatment of heartwater in sheep in the early stages of the disease. Over 50 sheep artificially infected were used in four experiments. Some 15 cattle naturally infected were also treated.

It was found that aureomycin was of definite value in the treatment of the disease and it was considerably more effective than the sulphonamides. The minimum therapeutic dose for sheep was 2·5 mg. per lb. bodyweight given intravenously either as a single dose or in divided doses at intervals of 24 hours. Even advanced cases in cattle responded to doses of 2 to 2·5 mg. per lb.

Prophylactic or curative administration in doses up to 20 mg. per lb. in sheep did not interfere with subsequent development of immunity.

D. L. H.

* **Aureomycin in the Treatment of Heartwater.** Weiss, K. E., Haig, D. A., & Alexander, R. A. (1952). *Onderstepoort J. vet. Res.* **25**. 41.

* * * * *

Cord Blood Flow and Foetal Growth*

Using data previously published on blood flow through the umbilical cord of foetal guinea-pigs and foetal sheep, the authors have calculated the blood flow associated with the laying down of 1 g. of foetal tissue. The calculations show a marked species difference, for in sheep foetuses (68 to 4,200 g.) the average blood flow is 5·5 (S.D. 1·6) l. per g. of tissue laid down, while in guinea-pig foetuses (14 to 106 g.) the average blood flow is 1·28 (S.D. 0·38) l. per g. of tissue laid down. The sheep foetus requires three to four times more blood in the placental circulation than the guinea-pig foetus during the formation of 1 g. of new tissue.

F. R. B.

* **The Relationship between the Blood Flow in the Umbilical Cord and the Rate of Foetal Growth in the Sheep and Guinea-pig.** Greenfield, A. D. M. (1951). *J. Physiol.* **115**. 158–162.

REPORT

[Veterinary Services Council, New Zealand: Sixth Annual Report and the Proceedings of the Fifth Annual Conference.]

The Veterinary Services Council is set up under a New Zealand Statute—The Veterinary Services Act, 1946. The Council consists of 10 members, three of whom represent the Government, and the remainder represent the Dairy, Meat and Wool Boards, the New Zealand Veterinary Association and veterinary clubs. As at present constituted the Council has four members who are veterinary surgeons. The Chief Executive Officer is also a veterinary surgeon.

It is the policy of the Council to extend the provision of Veterinary Services in New Zealand by promoting and encouraging the establishment of veterinary clubs or other like bodies in districts where adequate veterinary services are not available. The clubs are farmer controlled and the veterinarians salaried officers.

The Sixth Annual Report of the Council, covering the year's working up to March 31st, 1953, has been presented to the Hon. Minister of Agriculture.

The expansion of the services is self evident. In 1947 there were 50 veterinary surgeons employed by clubs. This number has increased to 124 : of these, 21 are practising in the South Island and 103 in the North Island. The overall figure will be raised to 150 when 26 further appointments to meet present requirements are made.

Addressing the Fifth Annual Conference, Mr. S. W. Smith, M.P., Parliamentary Under-Secretary for Agriculture, said :—

> "They had 124 veterinarians to-day, and that had not been achieved by accident, but in the first place was the result of the vision of the originators of the Scheme and the energy put into it by all of them, and by the willingness of the dairy companies to shoulder some of the financial responsibility for the welfare of the clubs. The veterinarians themselves had played a very important part by making the farmers veterinary minded. It had not been achieved without growing pains, without some difference of opinion, without some give and take, nor without the use of a great deal of common sense over the years, but the result achieved must give a great deal of satisfaction to all of them who were there that day. They had succeeded in giving the farmers a stock service that he thought was unequalled anywhere in the world."

The funds at the disposal of the Veterinary Services Council are at present limited to £100,000 per annum, and with 124 veterinary surgeons employed, £72,000 is absorbed by grants to clubs. Bursaries are awarded by the Council to enable selected students to study veterinary science. During the year under review the Council granted 12 new bursaries tenable at Sydney University. This brings the total number of bursaries granted since inception six years ago up to 59.

One short term overseas scholarship was granted, enabling a club veterinarian to visit the United Kingdom. Three refresher courses for club veterinarians were held during the year and were well attended. A wide variety of subjects was dealt with by veterinarians, research workers and visitors from overseas.

A Veterinary Services Council award, to the value of 50 guineas, has been instituted. The first presentation was made during the year to a young club veterinarian for his contribution to the knowledge gained on leptospirosis.

. . . . .

The Annual Conference was held at Hamilton on May 19th, 1953, when the Veterinary Services Council met delegates from veterinary clubs. In all, 59 clubs were represented by 116 delegates.

In addition to the Parliamentary Under-Secretary for Agriculture, the Conference was addressed by Mr. A. Linton, C.B.E., Chairman of the Council, Mr. D. Hendrie, Agricultural Attaché to the United Kingdom High Commissioner, and Mr. G. A. Walsh, M.P.

Apart from the organisation and problems of a domestic nature, the Conference was keenly interested in a wider field affecting the efficiency of Veterinary Services to the farming community of the Dominion. In this category was the proposed enquiry into the desirability of establishing a Veterinary School.

The Council expressed its intention to continue certain field surveys without being involved in fundamental research work which was the function of the Animal Research Division of the Department of Agriculture. The field surveys embrace such problems as sterility in rams, mortality in young lambs, temporary sterility and "bearing trouble" in ewes. In both sterility problems and "bearing trouble" the Council has provided appreciable funds to further the projects.

Other matters interesting the Conference were the establishment of additional diagnostic centres and a proposed scheme for the eradication of tuberculosis in bovines.

C. V. D.

NOTES AND NEWS

Diary of Events

Oct. 5th.—Meeting of the Ayrshire Division, B.V.A., at Ayr (Dalblair Hotel), 2.30 p.m.

Oct. 7th.—Meeting of the Lancashire Division, B.V.A., in the Liverpool School of Tropical Medicine, Pembroke Place, 2.30 p.m.

Oct. 8th.—Meeting of the Essex Veterinary Society at the Essex Institute of Agriculture, Writtle, Nr. Chelmsford, 7.30 p.m.

Oct. 8th.—Meeting of the Western Counties Division, B.V.A., at Exeter (Imperial Hotel), 2.15 p.m.

Oct. 9th.—Meeting of the Society of Practising Veterinary Surgeons at Shrewsbury (Raven Hotel, Castle Street), 2.30 p.m.

Oct. 9th.—Meeting of the North of Ireland Division, B.V.A., at Queen's University, Belfast, 7.15 p.m.

Oct. 9th.—Meeting of the Welsh Branch, B.V.A., at Newtown (Bear Hotel), 2 p.m.

Oct. 14th.—Meetings of the Editorial Committee, B.V.A.: Main Committee 2 p.m.; Executive 2.30 p.m.

Oct. 14th.—Meeting of the South-East Midlands Division, B.V.A., at the Laboratories of the Animal Health Trust, Newmarket.

Oct. 15th.—Meeting of the Herts and Beds Division, B.V.A., at St. Albans (70, Holywell Hill), 7.30 p.m.

Oct. 16th.—Meeting of the Mid-West Division, B.V.A., at Clifton (The Berkeley Café), 2.15 p.m.

Oct. 20th.—Annual Dance of the Mid-West Veterinary Association, at the Grand Hotel, Bristol.

Oct. 21st.—General Meeting of the South-Eastern Veterinary Association, B.V.A., at the Royal Star Hotel, Maidstone, 2.30 p.m.

Oct. 21st.—Meeting of the Section of Comparative Medicine, Royal Society of Medicine, at 1, Wimpole Street, W.1, 5 p.m.

B.V.A. Council and Committee Meetings

The following are the arrangements for the next meetings, which will be held in London on Wednesday, Thursday and Friday, November 11th, 12th and 13th, 1953:—

Wednesday, November 11th

11.30 a.m. Parliamentary and Public Relations Committee.
2.0 p.m. Veterinary State Medicine Committee.

Thursday, November 12th
10.0 a.m. Organising Committee.
12.0 noon. Home Appointments Committee.
2.0 p.m. Finance Sub-committee.
2.30 p.m. General Purposes and Finance Committee.

Friday, November 13th
11.0 a.m. Council Meeting.

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PERSONAL

Forthcoming Marriage.—Reid—Collier.—The engagement is announced between John H. Reid, M.R.C.V.S., younger son of Mr. D. T. Reid, M.R.C.V.S., and Mrs. Reid, of 44, Coldstream Place, Glasgow, N., and Beryl Maureen Collier, only daughter of Mr. and Mrs. F. Collier, of 203, Noel Road, Acton, London, W.3.

Marriages.—Burman—Stockton.—On September 12th, 1953, at Nantwich Parish Church, Nantwich, Cheshire, Peter Burman, M.R.C.V.S., only son of Mr. and Mrs. F. H. Burman, of Balsall Common, Nr. Coventry, to Margaret G. Stockton, eldest daughter of Mr. and Mrs. J. T. Stockton, of Nantwich.

Williamson—Milsom.—On Saturday, August 1st, 1953, at East Retford Parish Church, Retford, Notts, Captain Philip Taylor Williamson, R.A.V.C., only son of Mr. and Mrs. R. T. Williamson, of Lostock, Bolton, Lancs, and Miss Josephine Anne Milsom, youngest daughter of Mr. and Mrs. C. H. Milsom, North Road, Retford.

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R.C.V.S. OBITUARY

Lloyd, Richard Edward, M.R.C.V.S., of Cheriton, Vergam Terrace, Fishguard. Graduated London, July 15th, 1910. Died at his home, September 16th, 1953.

Pugh, John, M.R.C.V.S., Captain late R.A.V.C., 9, Conway Court, Marina, St. Leonards-on-Sea. Graduated London, December 23rd, 1895. Died September 17th, 1953; aged 85 years.

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N.Y. COMMONWEALTH FUND: BRITISH PROGRAMME OF FELLOWSHIPS

The Commonwealth Fund, New York, announces its British programme of Fellowships for advanced study and travel in the United States in 1954. In the British programme there are six categories of Fellowships, each is open to British subjects (men and women) who are not normally resident in or near the Americas and who have not previously worked or studied for more than a few months in the United States. The Fellowships provide for all expenses of travel, study and living; married men are expected to assume responsibility for their families, but some adjustment of Fellowship stipends is made to enable them to become candidates. The following categories are included:—

General.—Twenty Fellowships are offered to degree graduates of a university in the United Kingdom of Great Britain and Northern Ireland. Candidates must be available in London for interview in March, 1954. Age: 23 to 32. Tenure: 12 to 21 months. Closing date of applications: *December 15th*, 1953.

Home Civil Service.—Five Fellowships are offered to permanent members in the higher ranks of the Civil Service in Great Britain, three for the administrative grades and two for the scientific and professional grades. Age: under 40. Tenure: 6 to 12 months. Closing date of applications: *December 31st*, 1953, to the Treasury.

Dominion Civil Service.—Five Fellowships are offered to civil servants in the Governments of Australia and New Zealand. Age: under 40. Tenure: 12 to 21 months. Closing date of applications: *December 31st*, 1953.

Colonial Civil Service.—Two Fellowships are offered to civil servants in the Governments of British Colonies, Protectorates and Trust Territories. Age: under 40. Tenure: 6 to 12 months. Closing date of applications: *November 16th*, 1953, to the Colonial Office, London.

Conditions of eligibility, award and tenure for each category of the Fellowships are published in separate memoranda. Applications should be submitted on the prescribed form. The appropriate memorandum with application form attached may be obtained through British universities or through Government departments, or from The Warden, Harkness House, 35, Portman Square, London, W.1.

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GLASGOW UNIVERSITY DEGREE OF B.V.M.S.

The following passes at Glasgow University Veterinary School are announced:—

Degree of B.V.M.S.

Third Professional Examination—Part III.—Animal Husbandry and Preventive Medicine: Beaton, D.; Begg, H.; Horton, F. L.; Lawson, J. B.

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax:
Cumberland.—Beech House, Cumwhinton, Carlisle (Sept. 22).
Hants.—Greenwood Farm, Old Odiham Road, Alton (Sept. 24).
Salop.—Erway Farm, Dudleston, Ellesmere (Sept. 24).
Staffs.—Whitehurst Farm, Dilhorne, Stoke-on-Trent (Sept. 23).

Fowl Pest:
Hants.—13a, Alsford Road, Purbrook, Portsmouth (Sept. 23).
Sussex.—Audiburn Farm, Kingston, Lewes (Sept. 24).

Swine Fever:
Beds.—Shroma, New Road, Clifton, Shefford (Sept. 23).
Bucks.—Yewtree Farm, Stoke Mandeville, Aylesbury (Sept. 23).
Ches.—Ivy Farm, Little Neston, Wirral; Tollemache Arms Hotel, Taddiley, Nantwich (Sept. 24); 18, Holding, Shotwick Park, Chester (Sept. 26).
Cornwall.—Lower Bodrivial, Camborne; Tranno Breage, Helston; "Pencoys," Crowntown, Helston (Sept. 23); Polglase Farm, Leedstown, Hayle (Sept. 25).
Denbighs.—Rosbine Farm, Gwersyllt, Wrexham (Sept. 23); Bryn Celyn, Abyw, Ceodpoeth, Wrexham (Sept. 24).
Essex.—Berwyk Hall Farm, White Colne, Halstead (Sept. 25); White City Gardens, Gt. Leighs, Chelmsford (Sept. 26).
Flints.—Derby Road, Caergwrle, Wrexham (Sept. 26).
Lancs.—New Farm, Glazebrook Lane, Rixton with Glazebrook, Warrington (Sept. 25).
Leics.—Highfields Farm, Blaby, Leicester (Sept. 25).
Middx.—Blanche Farm, Blanche Lane, Barnet (Sept. 24).
Midlothian.—Comiston Farm, Colinton, Edinburgh (Sept. 25).
Norfolk.—Ferry Farm, Runham Vauxhall, Gt. Yarmouth (Sept. 25th); Allotments, Norwich Road, Cromer; Gardens opposite Prospect Villas, Cromer Road, Holt (Sept. 26).
Notts.—Home Farm, Rampton, Retford (Sept. 26).
Salop.—Firncliffe, Bridgnorth (Sept. 23).
Staffs.—2, New Street, Bridgtown, Cannock (Sept. 23).
Suffolk.—Home Farm, Culford, Bury St. Edmunds (Sept. 23).
Surrey.—Stream Farm, Whitmore Vale, Hindhead; Frosbury Farm, Gravetts Lane, Worplesdon (Sept. 23).
Yorks.—Fox House, Braithwell, Rotherham (Sept. 23).
Worcs.—Kingsford Farm, Wolverley, Kidderminster (Sept. 26).

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"RISK OF DISEASE FROM IMPORTED PIGS"

After Mr. D. J. Anthony, citing the possible occurrence of Trichinosis (*Vet. Rec.* **65.** 600), comes Professor W. I. B. Beveridge, Head of the Department of Animal Pathology at Cambridge, who in an address to Cambridge Rotarians suggested (reports the *Cambridge Daily News* in its issue of September 17th) that live pigs imported to this country from Sweden may bring with them the risk of a disease from which British pigs so far have been immune. Following a talk on the place of the veterinarian in the community, he was asked by a Rotarian about the 103 pigs from Sweden reported to have been sold in this country for £94,000 (with £5,000 for a boar and three gilts). Professor Beveridge said if the aim of the buyers was to establish a stud, as presumably it was, they might recover the cost. He added, "Whether Swedish pigs are superior to English I don't know. It is a point on which experts differ. But there is a disease called rhinitis which exists in America and Sweden and is giving great concern. It does not exist in this country. It is a very insidious disease. I am wondering if we may be running a big risk. These pigs are being kept under close observation for a year or two so that if the disease shows itself it can be stamped out."

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PROTECTION FOR CROCODILES

The Nairobi correspondent of *The Times* reports that the High Commission's Legal Secretary, Mr. C. D. Newbold, has warned the Legislative Assembly that crocodiles in Lake Victoria are fast disappearing. He said that they played an important part in the ecological balance, and there was some scientific evidence that their extermination might have a serious effect on fish life. An African member, Mr. B. A. Ohanga, who lives at the lakeside, said that the crocodiles were a menace to livestock and human beings and that the best thing was to kill as many as possible.

The Assembly approved regulations for the control of hunting and killing by a licence system. There has been a rapid expansion of the crocodile skin industry, which is lucrative.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

OBSERVATIONS ON SCHEME FOR INOCULATION OF SWINE WITH CRYSTAL VIOLET VACCINE

Sir,—Without going into great detail, it is suggested that a scheme be instituted whereby pig breeders may have their swine inoculated against swine fever by their own veterinary surgeons; the fee payable for this slight service, excluding the cost of the vaccine for 10 pigs, amounts to £1 7s. 6d.

A pamphlet just received from the Ministry lays down certain conditions for use of this vaccine which constitutes the *slight* service mentioned above, *viz.*, to earn the amount stated:

(i) Syringes and needles must be heat sterilised, *i.e.*, immersed in boiling water for at least five minutes, before use and again after use.

(ii) A separate needle for each pig is recommended.

(iii) Fractional contents in bottles should be discarded—*i.e.*, anything from 5 c.c. to 45 c.c.

(iv) It is essential that the veterinary surgeon should avoid contact with other herds of pigs for at least 24 hours before carrying out vaccination.

(v) Adequate and properly sterilised clothing must be worn.

In the light of these so-called sensible precautions outlined above, it is now necessary to review in greater detail the charges allowed for the service.

The fee for 10 animals: £1 7s. 6d.—This apparently necessitates the following from a veterinary surgeon, *viz.*:

(*a*) No visit to any pig within 24 hours preceding visit.

(*b*) Turning out in car, for which 7s. 6d. is allowed (already included in total fee).

(*c*) Provision of at least two or three syringes and 10 needles; cost of sterilisation of same; cost of breakages of syringes, loss of needles, and the discarding of unsuitable needles.

(*d*) The cost of ordering vaccine, and payment of accounts to Ministry. Cost of booking and sending of accounts and receipts to client. The discarding of opened bottles—not to be used on any other farm, vaccine being charged both to veterinary surgeon and client at 2s. per 5 c.c. It should be noted here that the client pays only for the number of pigs vaccinated; the veterinary surgeon for the amount of vaccine used and discarded.

(*e*) The provision of *adequate* and *properly sterilised* clothing means expensive garments for wear, the purchase of suitable disinfectant, and the time necessary properly to sterilise the clothing.

(*f*) *The time, care and skill* necessary to perform the injection of possibly 10 fractious or 10 quiet pigs.

The turn out fee will be necessary in practically every case to cover running and maintenance costs of the car, therefore to cover the remainder of the procedure £1 is allowed.

To say that this fee is niggardly is to put it in the most mild terms. I can visualise in the future the instigation of a scheme by the Ministry to aid impoverished veterinary surgeons—impoverished by attempting to run the above scheme. Perhaps when such a scheme is instigated the farmers will subsidise the veterinary surgeon by, say, 5s. on every fat pig to compensate for the subsidy which the veterinary surgeon is to-day expected to give to the farmer by inoculating his pigs for a fee which is more than swallowed by incidentals.—Yours faithfully, F. W. Logue, 93, Head Street, Halstead, Essex. *September 19th*, 1953.

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"THE SCIENTIFIC APPROACH TO ANIMAL WELFARE"

Sir,—In your issue of September 19th there is printed an admirable paper, "The Scientific Approach to Animal Welfare," given by Dr. Wooldridge to the meeting of the British Association for the Advancement of Science, in Liverpool, on September 7th. However, a certain "principle of thought" contained therein requires comment.

The view that "a superficial appreciation of domestication leads to the conclusion that the advantages accruing to the animal far outweigh any possible disadvantages. In effect, the essence of domestication is the removal of the major worries of an independent existence," as given in this context, is followed by several paragraphs concerning the disadvantages of domestication, *i.e.*, disease, etc. Here it is rightly surmised that the removal of a species of animal from its natural habitat, its domestication and subjection to a vast field of domestic diseases, must be a disadvantage to the animal.

However, it is assuming a lot to say—again according to the contect—that "the standard of living of an animal rises with domestication." The tendency to-day in progressive farming is to put the animal back into surroundings which simulate its natural habitat. With all due respect to those who act as spokesmen on behalf of animal welfare, we cannot justify the unnatural domestication of animals into machines by saying it is an advantage to the animal, or that their standard of living is improved.

However, as it is the system and the way of things to-day, we must make every effort, as outlined in the words of Dr. Wooldridge, to achieve a more scientific approach to animal welfare. Let us not deceive ourselves into believing that domestication of animals is morally correct; it is, in fact, only desirable for the needs of man.—Yours faithfully, J. H. M. Cole-Powney, "Swinfen House," 22a, Talbot Road, Carshalton, Surrey. *September 22nd*, 1953.

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R.C.V.S. ANNUAL FEES

Sir,—All members of the profession have just been circularised regarding the 300 per cent. rise in fees. This letter included a polite request to expedite payment for the current year, and if the rest of the letter had been constructed in the same spirit there would be little to complain about.

Two points, however, stand out rather startlingly. No explanation is given for this vast increase, and most members I have spoken to are quite unaware that the new methods of education and examining have ended the former immoral practice of the R.C.V.S. of deriving the bulk of its income from examination fees. The second fault of this letter is the offensive wording of the penultimate paragraph, which, apart from an airy reference to certain safeguards, threatens all and sundry with expulsion from the register in future years if payment is not made dead on time. No reference is made to any need for reminders, and one might quite justifiably draw the conclusion that a busy member who allowed the awful day to pass might next day receive a peremptory note from the Registrar informing him that he was no longer licensed to practise.

This is not the only example of autocratic behaviour by the Council, R.C.V.S., in recent years. It is, I believe, a result of the fact that the Council is out of touch with the people it is supposed to serve, as will always tend to happen with single constituency election, where very few of the electors can have much knowledge of the candidates. It therefore behoves the B.V.A., whose Council is much more in touch with the profession, to hold a watching brief to protect us. If the B.V.A. took an active part in R.C.V.S. elections I suspect the Council would be less unbending.—Yours faithfully, W. H. Parker, 4, Richmond Avenue, Wolverhampton. *September 20th*, 1953.

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN

Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period	Anthrax	Foot-and-mouth	Fowl Pest	Sheep Scab	Swine Fever
16th to 31st August, 1953	12	—	15	—	87
Corresponding period in—1952	71	9	9	—	24
1951	10	2	9	—	119
1950	8	3	1	—	42
1st January to 31st August, 1953 ...	477	28	708	—	2,121
Corresponding period in—1952	487	478	151	1	644
1951	299	28	595	4	755
1950	258	19	102	19	93

Tuberculosis (Attested Herds) Schemes

The number of Attested Herds, *i.e.*, herds officially certified as free from tuberculosis as at August 31st, 1953, was as follows:—

England	Wales	Scotland	Total (Great Britain)
51,695	28,419	26,541	106,655